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TYPHUS FEVER AND TYPHOID FEVER.

A REPORT ON PAPERS READ AT THE SOUTHERN MEDICAL ASSOCIATION MEETING AT JACKSONVILLE, FLA., NOVEMBER 12-14, 1912.

By JOSEPH GOLDBERGER, Passed Assistant Surgeon, United States Public Health Service.

At the meeting of the Southern Medical Association in Jacksonville November 12–14, 1912, a number of interesting papers having public health bearing were presented. Of very special interest was a paper presented by Dr. J. E. Paullin of Atlanta, Ga., on typhus fever. In this paper Dr. Paullin reports seven cases of typhus observed in Atlanta since 1910. The features of these cases are summarized by him as follows:

TYPHUS FEVER IN ATLANTA, GA.

Onset has been sudden, with chills, as a rule; intense aching pain in back and limbs; persistent and intense headache, in two cases severely distressing to the patient, and remaining throughout the course of the disease; delirium was present in one case; prostration has been quite marked in all of the cases. The eyes are generally bright and shiny, the face flushed, tongue heavily coated; between the fifth and eighth day of the disease the characteristic eruption appears first on the chest and abdomen, rapidly spreading to the back, arms, forearms, hands, neck, face, legs and feet, although it is stated that frequently it is absent from the face. The rash resembles somewhat the typhoid roseola; it is more extensive and of a brighter color, maculopapular, varying in size from 1 to 12 mm. in diameter, appearing rapidly over the body, becoming petechial in places and not completely disappearing under pressure. In these cases the rash had completely disappeared before the subsidence of the fever, leaving behind a darkish brown discoloration, which soon disappears. The rash has not been observed on the buccal mucosa. No subcuticular flushing has been noted in these cases.

The temperature is high from the onset and having within the first few days reached its fastigium maintains this with very slight remissions for 10 to 15 days, when it ends by lysis or crisis. With a normal temperature the patients feel well, and headache disappears. The pulse is, as a rule, full, good volume, occasionally dicrotic; slow in comparison with the height of fever.

The spleen has been palpable at the first examination in all of the cases except one, the percussion area of splenic dullness is here increased. The border is hard and firm. The largest spleen—Case VI—extended 3.0 cm. below the costal margin. All of the cases have shown a slight leucocytosis, the highest count 12,400—the lowest 7,000. Repeated widals with the *Bacillus typhosus* and *Bacillus paratyphosus* have been negative.

Blood cultures have been made on all cases except the first two, all remaining sterile.

Most patients have had a slight bronchitis at the beginning of the disease, and in two it persisted throughout its course.

There have been no relapses in these cases and no complications.

This paper is of very great practical importance because it emphasizes what Dr. Anderson and myself have several times stated—that typhus fever is endemic in the United States, a fact which physicians and sanitarians do not as yet sufficiently appreciate.

Two other papers of wide practical public-health interest were presented in the section on preventive medicine, one "The present status of our knowledge regarding the transmission of typhoid fever," by Dr. A. W. Freeman, and the other, "Fly-borne typhoid fever and its control in Jacksonville," by Dr. C. E. Terry. These two papers are of such wide sanitary interest that I would recommend their publication in the Public Health Reports and herewith transmit copies of them for that purpose.

THE PRESENT STATUS OF OUR KNOWLEDGE REGARDING THE TRANSMISSION OF TYPHOID FEVER.

By ALLEN W. FREEMAN, M. D., Assistant Commissioner of Health of Virginia.

With the possible exception of tuberculosis, there is no disease in all the long catalogue of those classed as infectious which has been more studied than has typhoid fever. Both diseases present complex epidemiology, and in both effective practical prevention has come only after long and arduous study. The epidemiology of typhoid fever has become more complex as our knowledge has increased. The infectious agent of the disease can survive for a long enough time and under sufficiently varied conditions to render the study of its transmission difficult in the extreme.

Prior to the discovery of the specific etiological agent of typhoid fever the studies which were made were for the most part fragmentary and unsatisfactory, and until the time of Budd, whose immortal work has never received the recognition which it deserves, nothing of great value in the specific prevention of the disease had been recorded. Budd, whose researches will always remain a model for pure epidemiology, clearly established the infectious nature of the disease, located the infectious agent in the excreta of the patient, and laid the foundation for our modern ideas regarding the disease. The discovery of the infectious agent, coming shortly after the publication of Budd's work, gave great impetus to the prevention of typhoid fever, and from that time to this the history of sanitary science records a continuous series of triumphs over the disease.

At the present time, in summing up our knowledge regarding typhoid fever, we may say without hesitation that it is caused by the *Bacillus typhosus* of Eberth. The work of Metchnikoff and Besredke, together with the results of antityphoid vaccination, have disproved forever the theory so frequently advanced that typhoid fever is of the same nature as swine cholera, and the typhoid bacillus only a secondary invader, the real infectious agent being a filterable virus to be found in the blood.

We may say, too, with certainty that the typhoid bacillus is of much wider distribution than was thought, even up to a few years ago. It is to be found in the discharges not only of the patient, but of many healthy persons, who may or may not have had the disease, and in the discharges of many persons who are sick with intestinal fevers so mild as to bear little or no clinical resemblance to true typhoid fever.

We have learned within the past few years that the typhoid bacillus is disseminated, not only as was formerly thought, by water and milk, and occasionally by other foods, but also by flies and fingers and in fact by almost any material object which comes in contact with human filth, and directly or indirectly with human mouths. We have learned by sad experience that the measure of typhoid fever in any community is the measure of the distribution of human filth in that community, and that the dissemination of human excrement will inevitably result in the spread of typhoid fever.

Water has, of course, long been regarded as the great carrier of typhoid infection, and rightly so. Sometimes in epidemics, sometimes in the continuous infection of a large population, sometimes in scattering single cases, water must be held responsible for a considerable proportion of our typhoid. Without adequately protected or purified public and private water supplies, typhoid prevention is impossible.

Milk has, likewise, for many years been regarded as a most important vehicle for typhoid infection. Epidemics without number have been caused by infection of milk supplies. Experience, dearly bought, has demonstrated that even the most rigid inspection of milk supplies can not prevent the occasional infection of a public supply, and that real protection against typhoid fever from infection of milk supplies is to be purchased only at the expense of pasteurization under municipal supervision.

Other food causes of typhoid infection have received much attention, but in spite of much study little has been learned as to their real importance. We have seen much agitation of recent years in regard to the rôle played by shellfish, and particularly oysters, in the transmission of typhoid. A careful study of the evidence would seem to show that while an occasional outbreak of typhoid has been found to be due to infection of oysters, in such cases the pollution has been obvious and inexcusable, such as the fattening of oysters in the harbors of large cities or even at the mouths of sewers. We believe that for the most part the average market oyster is not the cause of any great proportion of our typhoid and is in fact about as safe as any of the foods which we are in the habit of eating uncooked.

TYPHOID FEVER IN CITIES AND TOWNS.

The studies which have been made of the prevalence of typhoid fever in the cities and towns of the United States have revealed much that is of value in the prevention of the disease. The relative value of water purification, general sanitation, and food protection has been worked out in detail and the practical prevention of the disease has been made almost an exact science.

Everyone knows that frequent explosive outbreaks of typhoid fever have occurred as a result of the infection of public water supplies. From such supplies the typhoid bacillus has been recovered so frequently as to leave no doubt of the accuracy of the results. It has been proved too many times to admit of further question that the use of an impure water supply by a community will result in a continuously high typhoid rate, and that purification of such a water supply will result in a marked and immediate lowering of the rate.

In cities in the more northern sections of the United States the purification of a public water supply of a city will result in the reduction of the annual typhoid death rate to a figure usually under 20 per hundred thousand. In the South the purification of the public water supply will in the absence of other measures seldom bring the figure below 50 per hundred thousand. In a southern city, possessing a pure public water supply, the sanitation of the city, and by sanitation is meant the complete protection from human filth in the community by perfect sewering or by rigid screening and supervision of dry closets, will usually result in reducing the annual typhoid death rate to the figure usually reached by the northern city from water purification alone, namely, 20 per hundred thousand. Unfortunately no figures are available as to the result of the perfect sewering of any southern city of considerable size, as, so far as we are aware, such a city is not to be found.

No more important addition has been made to our knowledge of the practical prevention of typhoid fever in urban communities than the facts which have come to light regarding the importance of protecting the people of any community against that infection which is not brought in from without the city gates but which is generated within and disseminated from foci close at hand. When we seek to work out a plan of protection for the citizens of any community against typhoid fever we should classify accurately our sources of infection into two groups. We should first consider those sources of exogenous infection without the city, from which infection is brought in, usually in water, milk, or other food, and which are guarded against by water purification and milk and food inspection. We should by no means neglect those sources of endogenous infection within the city, whence typhoid is distributed by an almost infinite variety of means, and which must be guarded against by what we speak of as general sanitary measures, such as sewerage, sanitary inspection, fly prevention, and, in addition, by the very especial supervision of the known cases of typhoid fever.

TYPHOID FEVER IN RURAL DISTRICTS.

It is to be regretted that our knowledge regarding the transmission and prevention of typhoid fever in rural districts is far from being as complete as that regarding urban conditions. The subject is one which has been studied but little in this country, notwithstanding the fact that in many of our States typhoid fever is almost entirely a rural problem. We have learned, however, some facts regarding the transmission of typhoid fever in rural districts which are of value in practical prevention. We know that in most cases water infection has but little to do with the spread of the disease; that existing sanitary conditions in rural districts are utterly inadequate for the proper protection against human filth; and that the general dissemination of fecal matter consequent upon the presence of these insanitary conditions is inevitably followed by the presence of typhoid fever.

We know, too, that the country people at the present time have not learned those precautions which are absolutely necessary to prevent the spread of the disease from the bedside of the patient, and that frequently the disease is spread over large areas of country by contact alone. From our knowledge of the transmission of typhoid fever, taking into account the isolation and lack of intercommunication of the country people, we may confidently expect that an improvement in the sanitary arrangements of our farms, specifically in the building of a sanitary privy for every home and a more careful observance of the precautions of the sick room, will result in a marked decrease in the prevalence of typhoid fever in rural districts.

ANTITYPHOID VACCINATION.

The results already obtained indicate clearly that vaccination with killed cultures of the typhoid bacillus confers upon the individual marked resistance to typhoid infection. In military organizations the great value of this method of protection has already been demonstrated, and results are rapidly accumulating to show that in civil populations the method may also be of great service in the prevention of endemic and possibly of epidemic typhoid.

SUMMARY.

Summing up, we may say that the essential basis for the prevention of typhoid fever has been laid, and that we are now in possession of the information, biological and technical, necessary for the actual eradication of the disease from the urban communities of the United States. The basis for prevention in rural communities, while not complete, is sufficiently certain to insure a great reduction in present rates. The problem is no longer an investigative or scientific problem, but a problem of administration. When the people of the

United States wish to pay for absolute protection against typhoid fever it can be bought with the full assurance that the goods can be delivered.

CONCLUSION.

As physicians and sanitarians, we are most interested in the practical question, Can typhoid fever be prevented? We know that it can. We know that our methods are certain, that they will yield the desired result in every case where they are properly applied. The problem remaining for solution is how to convince the American people that protection from typhoid fever is something worth spending money for.

FLY-BORNE TYPHOID FEVER AND ITS CONTROL IN JACKSONVILLE.

By C. E. Terry, M. D., City Health Officer, Jacksonville, Fla.

It is not my intention in this paper to present any new facts regarding the carriage of typhoid fever by flies nor to make any valuable contribution to the literature on fly transmission of intestinal diseases, but rather to state an experience which is unique, I believe, in municipal sanitation.

The source of the water supply of Jacksonville, as well as systematic bacteriological examination of this supply, have enabled us, we feel, to completely eliminate it as a factor in the spread of our typhoid fever. The entire absence of open wells, owing to a city ordinance prohibiting them, removes such source of water supply from consideration. The only other water supply that could have been questioned in individual cases are the driven surface wells, and here again local conditions, namely, a perfect sand filter, which our soil furnishes naturally, has enabled us, after repeated examinations for possible sewage contamination of these wells, to disregard them as factors in the spread of this disease.

The city water is artesian from flowing wells of an average depth of a thousand feet. As it issues from these wells it is practically sterile, and outside of contiguous breaks in sewer and water mains there appears no opportunity for its contamination. No facts connected with any of our cases of typhoid fever would indicate that such an accident had ever occurred. Below is a table of the bacterial counts taken from reservoirs and taps in different portions of the city for the past three years. It will be seen from a perusal of this table that our supply is of unusual purity.

Bacteria in city water during 1910, 1911, and 1912.

Source of sample.	Number of samples.	Average number bacteria per c. c.	Bacillus coli.
City taps	26	20	Absent.
Reservoir	21	22	Do.
New reservoir	1	10	Do.
Reserve basin	9	116	Present.
South aerating basin	9	19	Absent.
North aerating basin	8	38	Do.

The average of all counts is 23 bacteria per cubic centimeter, exclusive of reserve basin. This basin is called upon only in case of emergency, such as large fires. It lies near Main Street and is uncovered. Twice *Bacilli coli* have been found in it, due probably to dust from the street and birds. In none of the other basins have we ever found the colon bacillus.

Together with the elimination of the water supply as a possible carrier of our typhoid fever, I have been able, since January, 1910, to eliminate milk as a factor, with the exception of three cases during the spring of the present year. The milk supply of every case occurring since January 1, 1910, has been determined, and in no instance has there been reason to believe that any milk route was at fault. In fact, only 16.6 per cent of all cases during 1911 and 1912 used any cows' milk prior to the onset of the disease. Since January, 1911, a case record has been kept of all the local conditions surrounding each case, such as milk and water supply, location as to privy or sewer district, recent contact with known cases, eating places, screening, etc.

With the elimination of water and milk, ordinarily the two main factors in the distribution of typhoid fever, it became apparent that some other common condition must be sought in order to account for the undue prevalence of the disease. There remained in my mind but two possibilities worthy of much consideration—contact cases and those due to fly carriage. My attention was first called while I was doing general practice in this city, prior to my appointment as health officer, to the possible agency of the fly, principally by the seasonal incidence of the disease. After my appointment, January 1, 1910, the distribution of the cases was found to be such as to corroborate this belief.

The conditions existing in the privy district at that time were such as to further in every way fly transmission of intestinal diseases. There were about 8,500 privies in the city which accommodated 40 per cent of our population. Had these privies been confined to any particular locality their existence would not have entailed such a widespread distribution of infection; but they were about evenly distributed throughout every section of the city. In fact, there was at that time no point within the city limits of Jacksonville farther than nine blocks from one or the other of the privy districts, while about 75 per cent of the population lived either in this district or within three or four blocks of it, notwithstanding the fact that their own premises may have had sewer connections.

These 8,500 privies were such as are commonly seen in rural districts, and I can truthfully say that not a single one made the slightest pretense of protection against flies; indeed, so poorly were they constructed that many had no backboards and more than one householder objected to the visit of the city scavenger on the grounds that the chickens did his work to the entire satisfaction of the family. Few had seat covers, all had wide cracks and unscreened windows and many of these privies in the poorer negro settlements lacked even doors, denying to the occupant the privacy which the name would indicate could we rely on etymology for meaning. A large proportion of these privies existed in thickly settled districts where only a few feet separated the cottages and where small yards required the placing of the privy close to the kitchen windows. In many instances, where a number of houses were owned by the same landlord, to economize space and money one community privy would be found within 25 or 30 feet of from three to six kitchens. Screens are not furnished to this class of tenants. Each privy was a reeking mass of filth swarming with flies which abandoned it only when the odor of cooking attracted them through the near-by windows. Surely here were present the three essentials to fly carriage of intestinal diseases—exposed human excrement, unprotected food supplies, and an abundance of flies. Ignorance and disregard for decency could scarcely have devised more ideal conditions for the dissemination of intestinal infections.

I regret that prior to 1910 scarcely any case reports were made to the health office, so that I can not determine the distribution of the disease before that period. The deaths, however, furnish sufficient information to show that its seasonal prevalence was the same as for the past three years. In 1910 we had a considerable increase in the number of deaths over the preceding two years. I attribute this increase in part to more accurate data and to the fact that the city had grown so rapidly during this period that sewerage extension lagged far behind the requirements and each year the number of new privies constructed outnumbered the new sewer connections. At the same time in default of any law governing the construction and maintenance of these places, the old ones were falling constantly into a worse state of repair.

During 1910 our attention was early called to the distribution of the cases and it was also noted that a marked increase occurred after the onset of the fly season. Careful observations on the prevalence of flies were made during this season about the public dumps and stables and it was found that they reached their height about the end of the first week in July, while the same month furnished the high-water mark of the typhoid cases reported.

Acting on this, we succeeded, in August, 1910, in securing the passage of an ordinance requiring all privies to be rendered fly proof. This ordinance was modeled after the one devised by Dr. Levy, of Richmond. Its enforcement was begun at once, and by April 1, 1911, the beginning of the fly season, between 80 and 85 per cent of all privies had been reconstructed according to its requirements. The ordinance required tight construction, the screening of ventilating openings, self-closing doors and seat covers, and well-fitting hinged backboard. In order to avoid, as far as possible, imposing unnecessary hardships upon property owners, the law was so framed as to permit the repairing of privies already constructed where it was possible in this manner to insure fly proofing. Where, however, such repairs would not have accomplished the desired result entire new construction was required.

Beginning with January, 1911, the department has required that the sick room in every case of typhoid fever be screened and the flies destroyed by means of poison or sticky fly paper. This routine has been carried out by detailing an inspector to visit each case every other day from the time of its reporting until convalescence is established. Where the financial condition of the family renders the screening of the sick room a hardship, mosquito netting, sticky fly paper, and disinfectants have been furnished by this department and their use has been strictly enforced and watched. Printed instructions supplement verbal ones in each case.

As a result, I believe, of the screening of the privies and sick rooms the number of cases of typhoid fever reported to the health department during 1911 was 158 against 329 for 1910, the deaths for the same years being 40 against 62. There was actually a greater reduction in the number of cases, as the reports for 1911 were more complete than those of 1910. Not only did this reduction occur, but we found that the distribution of the cases as to privy or sewer districts was practically reversed in 1911 from that of 1910, showing no disproportion of cases in the privy districts. The 1911 cases were distributed according to the population, regardless of methods of sewage disposal.

It is interesting to note that of the 158 cases occurring in Jacksonville during 1911, 88, or 55 per cent, were imported, the large majority from the surrounding country districts, where the privy and "back lot" unite to solve the question of sewage disposal. A large proportion of these cases are imported in the summer from rural communities where typhoid fever is continuously epidemic. In all of these settlements open privies are used. During 1911 the enforcing of the privy ordinance was vigorously pushed and by January, 1912, these places were in as nearly a sanitary condition as it is possible to keep them where 50 per cent of the population is composed of negroes devoid of responsibility, and others of the type which looks with ridicule upon the necessity for care in the disposition of human excrement, or is too indifferent to matters concerning the public welfare to observe more than the naked letter of the law.

The enforcement of this ordinance has cost property owners a large amount and it was not accomplished without considerable opposition from various sources, but the results obtained have removed most of the objections and during the past year notices to repair or reconstruct dilapidated privies have generally met with prompt, if not always cheerful, response.

The most marked reduction in the typhoid case rate has taken place this year. At the present writing we have had only 87 cases reported with 16 deaths. Of these, 48 acquired their infection elsewhere and were brought here for treatment. In only 39 cases could the infection be charged to Jacksonville. Three of these cases and one death were due to infected milk of a privately owned cow which supplied three families, a needless sacrifice to ignorance.

I am fully aware that the facts above stated do not furnish all the requirements of strictly scientific proof that our typhoid fever was for the most part fly borne, but it would appear that this was the case, as the only measures we have made use of to reduce our typhoid rate have been directed against this insect, and the only change in sanitary conditions throughout the city has been the fly proofing of the privies. Contact has undoubtedly played its part, as it does everywhere, but in view of the fact that our water and milk supplies could be eliminated, as already stated, I feel that we are justified in attributing the major portion of our cases, prior to the enforcement of the privy law, to the house fly.

There arises, in this connection, a point of considerable scientific interest, namely, just how the disease is transmitted by the fly. We have been taught that the fly infects food by means of the specific bacilli carried on its feet from infectious material. The commission appointed to investigate the causes of typhoid fever prevalence during the Spanish-American War call attention to the fact that flies "with their feet whitened with lime from the latrines" were seen walking over the food of the soldiers in the mess tents and kitchens. It has also been demonstrated by several investigators that flies fed on infected material will deposit the typhoid bacillus in their specks. Maj. N. Faichnie, Royal Army Medical Corps, in the November (1909) number of the Journal of the Royal Army Medical Corps, presents a most interesting paper on the exact source of this infection.

It is his opinion that neither the legs of the flies "nor their excreta when they feed on the contents of latrines are common vehicles of fly-borne infection"; quoting further from Maj. Faichnie:

> But, on the other hand, the chief and most common method is by excrement when the flies are bred in an enteric infected material. By this I mean that one station may swarm with flies, bred only from the excreta of cows and horses, and yet have no enteric; while another place, where there are very few flies, but where these are bred from human excreta either in or out of the station, may have an epidemic, the source of infection being the excrement of the flies, and the insects themselves being carriers.

Maj. Faichnie, in his report, adduces considerable evidence to support his contention. In view of his observations and some experiments which Dr. McKay and I conducted in 1911, I am inclined to believe, at least, that the fly bred in infectious material is a carrier for a longer period and hence more dangerous than the insect obtaining its infection through contact or feeding after maturity. It is a matter that is worthy of careful investigation. The fly-proofing of privies, however, is protection against either mode of infection, and I am convinced from inspections made of these places prior to the passage of our screening ordinance that, second only to stables, they furnished the most prolific fly hatcheries in the city.

What is true of Jacksonville is, I believe, true of many of our southern towns and cities, where the sewerage systems are inadequate to the requirements and where the old type of privy is in common use, and in such communities I am convinced the screening of these places will bear fruit in reducing the typhoid-fever rate, as it has done in Richmond, Asheville, and this city. The old type of privy is an abomination, and even the best is but a poor substitute for the sewer; but in the South, where lack of public funds, the poverty of large numbers of our people, and, as everywhere, politics retard sewerage extension, and where climatic conditions prolong the fly season, the rendering fly-proof of these places is a necessity if we would secure even reasonable immunity from the infections they entail.